

CLAIMS

We claim:

1. A suction device comprising a nozzle for sucking in the outside air,
5 wherein the suction device is structured in such a manner that:
a fluid nozzle is provided within the nozzle in order to expel a fluid toward
an opening of the nozzle;
when the opening of the nozzle is unobstructed, the outside air being
sucked into the nozzle through its opening causes the fluid being expelled out of
10 the fluid nozzle to be pushed back and sucked into the nozzle from its base end
without the fluid being ejected out of the nozzle; and
when the amount of the outside air sucked into the nozzle is decreased by
placing the opening of the nozzle close to or in contact with an object, the fluid
being expelled out of the fluid nozzle overcomes the outside air and thereby the
15 fluid is ejected toward the object, and the fluid that has struck the object is sucked
together with the outside air into the nozzle.
2. The suction device according to claim 1, wherein the nozzle has, in the
vicinity of the opening, at least one small hole capable of introducing the outside
20 air into the nozzle.
3. The suction device according to claim 1 or 2, wherein a fluid injection hole
of the fluid nozzle is located at a position recessed from the opening of the
nozzle.

4. The suction device according to claim 3, wherein either the amount of the outside air or the pressure of the fluid, or both of them, are adjusted so that:

when the opening of the nozzle is unobstructed, the pressure of the outside air corresponding to the amount of the outside air being sucked into the nozzle exceeds the pressure of the fluid being expelled out of the fluid nozzle in an area between the opening of the nozzle and the fluid injection hole; and

when the amount of the outside air sucked into the nozzle is decreased, the pressure of the fluid being expelled out of the fluid nozzle exceeds the pressure of the outside air corresponding to the amount of the outside air being sucked into the nozzle in the area between the opening of the nozzle and the fluid injection hole.

5. The suction device according to claim 1, wherein the cross-section area of the opening of the nozzle is determined based on the pressure of the fluid being expelled out of the fluid nozzle, thereby controlling the amount of the outside air sucked into the nozzle.

6. The suction device according to claim 1, wherein the distance between the opening of the nozzle and the fluid injection hole is determined based on the pressure of the outside air corresponding to the amount of the outside air being sucked into the nozzle, as well as the pressure of the fluid being expelled out of the fluid nozzle.

7. The suction device according to claim 1, wherein when the amount of the outside air sucked into the nozzle is decreased, the fluid being expelled out of the

fluid injection nozzle is ejected toward the object and the matter to be sucked in, which is adhering to the object, so that the matter, together with the outside air and the fluid that has struck the object and the matter, can be sucked into the nozzle.

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8. The suction device according to claim 1, wherein brushes are placed in an attachable and detachable manner at the top end of the opening side of the nozzle.

10 9. The suction device according to claim 1, wherein an elastic member is placed in an attachable and detachable manner at the top end of the opening side of the nozzle.

10. A nozzle device comprising:

15 a nozzle connected to a suction device; and

a fluid nozzle placed within the nozzle and connected to a fluid injection device in order to expel a fluid toward the opening of the nozzle;

wherein the nozzle device is structured in such a manner that:

20 when the opening of the nozzle is unobstructed, the outside air being sucked into the nozzle through its opening causes the fluid being expelled out of the fluid nozzle to be pushed back and sucked into the nozzle from its base end without the fluid ejecting out of the nozzle; and

25 when the amount of the outside air sucked into the nozzle is decreased by placing the opening of the nozzle close to or in contact with an object, the fluid being expelled out of the fluid nozzle overcomes the outside air and thereby the

fluid is ejected toward the object, and the fluid that has struck the object is sucked together with the outside air into the nozzle.

11. The nozzle device according to claim 10, wherein the nozzle has, in the
5 vicinity of the opening, at least one small hole capable of introducing the outside air into the nozzle.

12. The nozzle device according to claim 10 or 11, wherein a fluid injection
10 hole of the fluid nozzle is located at a position recessed from the opening of the nozzle.

13. The nozzle device according to claim 10, wherein brushes are placed in
an attachable and detachable manner at the top end of the opening side of the
nozzle.

14. The nozzle device according to claim 10, wherein an elastic member is
15 placed in an attachable and detachable manner at the top end of the opening side of the nozzle.